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This publication contains information regarding new developments of interest to agriculture based on laboratory and field investigations by the Du Pont Company. It also contains published reports of investigations at agricultural experiment stations and other institutions on subjects of the Company's products and other subjects of agricultural interest.

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TESTS DEMONSTRATE NUTRITIONAL VALUE OF METHIONINE FOR POULTRY

The successful outcome of a series of controlled feeding tests demonstrating the nutritional value of methionine for poultry has been announced by the Organic Chemicals Department of E. I. du Pont de Nemours and Company, which sponsored these tests.

Investigators in animal nutrition have long known that methionine is one of the essential amino acids. However, it remained for nutritionists collaborating in this work to prove the increased value of feed fortified with proper amounts of synthetic methionine.

Results of these tests are being compiled for publication. The data indicate that the added investment in methionine-fortified feed will yield poultry raisers a return of several hundred per cent.

The Organic Chemicals Department's interest in poultry nutrition is not new. Its research work in this field goes back to 1925, and early led to the development of "Cel-O-Glass" plastic coated wire mesh, which transmits ultra-violet light to birds confined in brooder and laying houses.

When World War II reduced the supply of Vitamin D supplements from natural sources, Du Pont joined in the world-wide experimentation and development which led to the commercial manufacture of "Delsterol" "D"-activated animal sterol.

Much of the department's nutrition research has been carried out at its Biological Laboratory in New Brunswick, N. J. Its director, Dr. James Waddell, is a member of the advisory board of the AGRICULTURAL NEWS LETTER.

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COMPACT KIT TO TEST STRENGTH OF LIVESTOCK DIP NOW AVAILABLE

How to be sure that the concentration in the dipping vat prepared from the newer insecticides remains of the proper strength has been a problem that has worried stockmen. They know they can start their dipping with everything in proper balance, but that the strength of the dip may change as the animals are being treated, or as a result of rain and evaporation. If the solution becomes too weak, it will not do a good job. If it is too strong, the animals may be injured.

Until recently it was not very simple to find out what the strength in the solution was, unless somebody with technical background and experience was at hand. This difficulty has been overcome for stockmen who use Du Pont Livestock Spray and Dip No. 30 by the development of a vat-side test, and simple diagrams for its use with equipment designed by a Wilmington chemist and equipment manufacturer, Dr. J. B. Leibee. He has assembled all the necessary equipment -- including thermometer, hydrometer, calibrated containers for vat samples, test tube, and chemical reagents -- in a convenient kit for shipment to any part of the country.

Proper Strength Should Be Maintained

Du Pont Livestock Spray and Dip No. 30 is a combination of DDT and benzene hexachloride (BHC). For the control of ticks, flies, and lice on livestock generally, its use is recommended at 11 pounds per 100 gallons of water. This corresponds to an insecticide strength of 0.7 per cent as determined by the vat-side test. For safe and effective results, the strength should be maintained in the range of 0.5 per cent to 0.9 per cent. With the kit and the diagrams that go with it, it does not take long to determine the insecticide strength in the vat. If it is not within the proper range, the chart will tell the proper amount of the product that must be added to each 100 gallons of liquid in the vat to bring it up to proper strength.

Information regarding the test and the test kit may be obtained by writing Dr. J. B. Leibee at his laboratory at 26 North Avenue, Boxwood, Wilmington, Delaware. Dr. Leibee also keeps a stock of replacement parts and chemicals used in the test.

METHOXYCHLOR AERIAL SPRAY USED TO PROTECT CALIFORNIA ALFALFA

A 25 per cent oil emulsion of methoxychlor for application to forage crops has been tested by key growers in the San Joaquin and Sacramento valleys of California with good results. A gallon of this emulsion in 30 gallons of water is suggested for aerial spraying on California alfalfa fields.

ORIGINS OF THE MODERN INSECTICIDE INDUSTRY *

By Dr. S. S. Sharp
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The origin of the use of chemical agents to prevent insect attacks, like many of man's modern practices, is lost in the mists of the past. The Roman naturalist, Pliny, reported several materials to be so used and there are even earlier records.

It was not until about 1870 that the use of insecticides became at all common in America. The depredations of two pests did much to speed the initial interest in chemical control of insects in this country. A beetle originally feeding on certain wild relatives of the potato in the Rocky Mountain area moved into the potato patches of the first settlers in that region and began a rapid and destructive sweep eastward over the newly settled plains to the more extensive potato plantings of the eastern states. This pest was the Colorado potato beetle.

At about the same period, the currant worm, an invader from Europe, became established on the east coast and moved westward. Control measures were sought for these two pests and it was found that Paris Green (copper acetoarsenite), a material previously used as a pigment, splashed onto potato plants, would protect them from the potato beetle. Paris Green remained for a quarter-century the standard stomach insecticide.

Kerosene Widely Used as Insecticide

It was long known that mineral oils were toxic to insects. About 1880 the use of a kerosene emulsion as an insecticide was started, and until the turn of the century this was the most common contact insecticide. Shortly after 1889, an Australian sheep dip compounded of a mixture of lime and sulfur came into use as a control measure for scale insects on dormant fruit trees. Large quantities of petroleum products and lime-sulfur are still used in the insecticide field. Decoctions of tobacco, in which the alkaloid nicotine was the active ingredient, also gained common use about this time.

Early results obtained with these products were somewhat erratic. Kerosene emulsions, lime-sulfur, and nicotine decoctions were made by the grower and varied widely in composition and effectiveness. In response to a definite demand for uniform products, the chemical industry started to make these pest control agents on a large scale under controlled conditions impossible for a grower to duplicate. This was the start of the modern large insecticide industry.

* Condensation of a paper presented at Pesticide Symposium, Chemical Engineers Club, Washington, D. C., Nov. 18, 1950.

Inorganics Came First

Insecticides used during the first four decades of this century were dominated by inorganic chemicals or natural products. Paris Green was succeeded by other arsenicals, chiefly lead arsenate, which remained for forty years the standard stomach insecticide. Cryolite (sodium fluoaluminate) and sodium and barium fluosilicates came into the field about 1930. Nicotine, extracted on a large scale from waste tobacco residues, became the most widely used contact insecticide. Two other natural products also came into prominence as contact insecticides. The first of these was pyrethrum, followed by rotenone. Nicotine (as nicotine sulfate), pyrethrum, and rotenone still find extensive application today.

Only a few synthetic chemicals, of which the thiocyanates were most common, were available in 1940 and they enjoyed but a small portion of the insecticide market.

Organic Synthetics Arrive

The period during and subsequent to World War II witnessed truly tremendous developments in the insecticide field, and these developments have been almost entirely in the realm of synthetic organic chemistry. The story is now well known how Muller and his co-workers at the Geigy Laboratories in Switzerland found early in this decade, that 2,2-bis (p-chlorophenyl)-1,1,1-trichloroethane (DDT), a chemical known since 1879, had extremely effective insecticidal action. There was a serious need for an effective insecticide for military use as a control agent for the lice, fleas, and other pests so important in spreading disease under the disrupted conditions associated with military operations. DDT offered the answer; it was first produced in this country in 1943 and in two years the annual production had risen to over 30 million pounds. Its remarkably rapid adoption was due to the waiting market for a product of unusually high efficiency against many insects. DDT is easily manufactured by the reaction of chloral and chlorobenzene.

Excellent though it is, and although it enjoys first rank in the field of insecticides, DDT is not necessarily the ideal insecticide. There are pests against which it is ineffective and other pests which are controlled better by other materials. Several other new insecticides have achieved substantial markets in spite of the competition of DDT simply because they are better products for certain purposes. Even before DDT became known in this country, 2,2-bis (p-methoxyphenyl)-1, 1,1-trichloroethane had been synthesized successfully. This compound, called methoxychlor, is effective against certain pests not controlled by DDT, and its lower mammalian toxicity permits application on dairy cattle, on vegetables and fruits close to harvest time and for other uses where DDT residue would be undesirable.

Benzene Hexachloride Makes History

The chemical 1,2,3,4,5,6-hexachlorocyclohexane, commonly called benzene hexachloride or BHC, has been known even longer than DDT, it having been

synthesized first by Faraday in 1825. It remained a gem unmined, however, until its insecticidal effectiveness was discovered by workers at the British firm of Imperial Chemical Industries in 1942. At first the British experienced considerable variation in the effectiveness of different samples of BHC, a difficulty that was resolved when it was learned that at least five different stereo-isomers of BHC exist, of which only one, the gamma isomer has any significant degree of insecticidal activity. The gamma isomer occurs to the extent of 10-20 percent in the technical product which is readily prepared by the photochemical chlorination of benzene. It can be separated by various techniques from the inactive isomers. The name lindane has been given to the substantially pure gamma isomer of BHC. BHC is effective against a wide range of insects, having found large scale usage on grasshoppers, aphids, livestock pests, and especially cotton insects. BHC is more volatile than DDT and shows definite fumigant action. Technical BHC has a pronounced characteristic odor, often described as "musty."

Other Synthetics Brought Out

The chemical 1,2,4,5,6,7,8,8-octachlors-4,7-methano-3a,4,7,7a-tetrahydroindane, which the Federal Interdepartmental Committee on Pest Control has named chlordane, is an American contribution to the insecticide field. It is made from cyclopentadiene and chlorine. Chlordane has found its largest use in grasshopper control, but is also effective against cockroaches, ants, fruit insects, etc. Aldrin and dieldrin are two other Diels-Alder condensation products that are becoming established in general insecticide usage. They seem especially successful on cotton.

Toxaphene differs from the insecticides previously mentioned in being produced from a natural product: camphene. Camphene, obtained from pine oil, is chlorinated to a chlorine content of 68 to 70 percent. Technical toxaphene is a waxy, low-melting solid which has found major uses in cotton insect and grasshopper control, but is useful against many other pests as well.

The compounds just discussed are broadly classified as the chlorinated hydrocarbons. They are all water-insoluble but can be dissolved in the ordinary organic solvents or even in kerosene in some cases. To a greater or lesser degree they are susceptible to alkaline decomposition, undergoing dehydrohalogenation in the presence of lime, ammonia, and other alkaline agents with resultant loss of insecticidal effectiveness.

Organic Phosphorus Compounds

The other large group of post-war insecticides is represented by the organic phosphorus compounds. During, or immediately preceding World War II, the German chemist Schrader, apparently as a part of the German chemical warfare research, found that certain compounds of this type had high insecticidal activity. Tetraethyl pyrophosphate is another example of a chemical known for many years (since 1854), but which was not discovered insecticidally until Schrader's studies.

Pure TEPP is a colorless liquid, miscible in all proportions with water. It hydrolyzes rapidly in the presence of moisture to form insecticidally inactive decomposition products. The high rate of hydrolysis limits the effectiveness of TEPP, but is also a boon since the rapid decomposition permits its use on food plants even within a day of harvest without any risk of residue hazard. TEPP can be produced commercially from triethyl ortho-phosphate and phosphorus oxychloride. The reaction results in a mixture of phosphates from which the TEPP can be isolated. TEPP, like other organic phosphorus insecticides, shows a high degree of activity against many insects, but it is finding its largest outlet in aphid and mite control.

Parathion is the common name given to o,o-diethyl-o-p-nitro-phenyl thiophosphate. The insecticidal value of this material is another of Schrader's discoveries, although the compound was patented years before for other purposes. Technical parathion is a dark brown liquid, immiscible with water. It can be synthesized from sodium ethoxide, $PSCl_3$, and sodium p-nitrophenate. Parathion is a contact insecticide and its effectiveness against a wide range of insects has gained for it extensive agricultural use. Its residual action is limited by a definite volatility. The compound is very toxic to warm-blooded animals.

EPN Is New Insecticide

Ethyl p-nitrophenyl thionobenzenephosphonate (EPN) is an organic phosphorus insecticide which appeared on the market in 1950. It has achieved wide use as a miticide and shows much promise as a general insecticide as well. EPN is characterized by a lower volatility and somewhat lower mammalian toxicity than parathion.

Another phosphorous compound has not yet attained any appreciable commercial status in this country, but is interesting because of its novel method of action. This compound, octamethylpyrophosphoramide, is characterized by its systemic action, i. e., the compound is absorbed into the plant either through the roots or through the foliage and is translocated within the plant, rendering the plant toxic to aphids and some other sucking pests that subsequently feed on it. Because thorough coverage is not essential with a systemic insecticide and because a material within the plant is immune to weathering, the systemic insecticides offer fascinating new control possibilities to the entomologist.

Pyrethrum, mentioned previously, is unique in having a very rapid paralytic action on insects, and is probably the safest of any known insecticide to warm-blooded animals. The insecticidally active ingredients of pyrethrum are four closely related compounds of such complexity that little hope was held for their practical synthesis. However, after years of study on the chemistry of pyrethrum, Dr. B. F. La Forge and his associates in the United States Department of Agriculture succeeded in synthesizing the allyl homolog of cinerin I, one of the components of pyrethrum. This compound has much of the activity of natural pyrethrum and is now being produced commercially.

Formulations Are Important

Chemicals are of value for the control of insects only as suitable formulations and equipment are available to bring them into contact with the insects concerned. The importance of formulations is not generally appreciated. None of the chlorinated hydrocarbons or organic phosphorus insecticides, with the possible exception of TEPP, are suitable for insecticidal use as manufactured. They must be compounded with satisfactory diluents, carriers, or inert materials before they can be mixed with water for use in sprays or applied as dusts. The chief formulations in which insecticides are used, are wettable powders, emulsifiable compositions, solutions in oil or other solvents, and dusts.

Some insecticides are relatively harmless to man and domestic animals while others are highly toxic. Their indiscriminate use would involve hazard, not only to the grower but to the consumer of food products treated with them. There is a growing awareness of the importance of using pesticides safely. It is essential that these valuable aids in the production of food be used in a manner that will not endanger the public health. Residues of toxic materials on treated crops are especially objectionable. While the government protects the consumer to some extent, it is also the responsibility of the manufacturers of insecticides and of state and federal entomologists to see that the users of such products are informed as to safe methods of handling and applying insecticidal materials.

How New Products Are Tested

What happens when an industrial laboratory finds a compound to be effective in its screening program? The first question is "How good is this find?"

Careful laboratory and greenhouse tests must be made to see how it compares with standard products. If the new candidate still appears promising, sufficient amounts of the material must be made to conduct at least small scale field tests, since the more severe conditions encountered in the field often bring out weak spots of a compound, not noted in the laboratory.

Lastly, large scale evaluation by independent state and federal investigators must be carried out before the new material can be logically recommended by the entomologist for introductory sales.

The entomologist is only one of many people interested in the development of this new product, however. Quite early in the developmental program, the toxicity of the new material should be determined; high toxicity may be a bar to proceeding with an otherwise effective chemical. Process studies must be initiated to explore possible methods of manufacture.

Needless to say, the synthetic method used for the laboratory preparation of a chemical may not be at all adaptable for commercial production. If a decision is reached to proceed with the new product, manufacturing facilities must

be made available, often requiring new construction. The steps just outlined in the development are both time-consuming and expensive--a period of several years and a research expenditure of several hundred thousand dollars can well be encountered between the synthesis of a new pesticide and the first return from the sale of the product.

WHITE BRASS PLATING PROCESS MAY HELP ALLEVIATE NICKEL SHORTAGE

A development that may help replace strategically short nickel in the automotive and other industries has been announced by the Du Pont Company's Electrochemicals Department.

Through it a "white brass" alloy is used to replace nickel as a base for chromium finish. This process is now the subject of intensive research work in the company's laboratories and in manufacturers' plants to adapt it to current production demands. The company emphasized that there are still a number of technical obstacles to be overcome.

In making bright decorative metal parts it is customary to plate chromium over deposits of copper or combinations of copper and nickel. However, in the current emergency, industry has been severely restricted in its use of nickel by government. The Du Pont development promises to help alleviate this problem by providing an acceptable replacement for the scarce nickel.

Process First Disclosed Thirteen Years Ago

Preliminary results indicate that chromium, plated over white brass, is indistinguishable in brightness and color from that plated on a nickel base. The white brass used in the Du Pont process is an 80/20 zinc-copper alloy which is electrodeposited from a cyanide bath using special brightening agents. From there on articles are chromium plated in the usual manner.

When nickel became short, technicians in the company's Electrochemicals Department went back to previous research on the subject. This was contained in a paper on a "White Brass Plating Process" given by a Du Pont man at the 26th annual convention of the American Electroplaters' Society in Milwaukee in 1938. The basic patent on the process was issued to the company the following year.

OUR WORST TRAMP

Weeds are great travelers; they are indeed the tramps of the agricultural world. They are going east, west, north, south; they walk, they fly, they swim, they steal a ride, they travel by rail, by flood, by wind; they go underground, and they go above, across lots, and by highways. But like other tramps they find it safest by the highway; in the fields they are intercepted and cut off; but on the public road every boy, every passing herd of sheep or cows, gives them a lift. Hence the incursion of a new weed is generally first noticed along the highway or the railroad. -- John Burroughs, Nebraska Certified Seed News.

PUBLIC HAS STAKE IN BRUSH AND WEED CONTROL

The public should be as interested in methods of keeping roadsides and rights-of-way free of brush and weeds as are highway departments, railroad companies, and public utilities, Dr. Arne E. Carlson, of the Grasselli Chemicals Department of the Du Pont Company said in a recent speech. He spoke at the South Dakota State Weed and Pest Control Conference at Mitchell, S. D.

"From a health standpoint," Dr. Carlson said, "the control of ragweed, goldenrod, and other heavy pollen-producing plants along roadsides is a boon to the hay fever sufferer. The killing of poison ivy and poison oak takes the 'itch' out of many a picnic and roadside hike."

Tall weeds and brush along highways and railroads often serve as "misplaced snow fences," building up drifts and blocking traffic, he said. Brush

that hides highway signs and guard rails may cause serious accidents. Noxious weeds such as Canada thistle and bindweed along roadsides produce seed that blow into nearby crop land, annulling efforts of farmers to control these pests inside their own fence lines.

Diversified Compounds for Separate Problems

"There is no one versatile herbicide which will kill all unwanted growth, and leave only the desirable growth," Dr. Carlson said, but he pointed out that there is a specific chemical now available for many of the weed, brush, and grass problems. These include such diversified compounds as 2,4-D, "Ammate" weed killer, 2,4,5-T, and TCA. Dr. Carlson stressed that knowledge of just which herbicide should be used for each separate problem is the key to the best and most economical results.

"With these new chemical tools," he said, "we can reach onto rights-of-way, or into corners and between railroad tracks, inaccessible to mowing machines and scythes. We are killing the roots of undesirable brush and perennial weeds, instead of just cutting off the tops. In the long run, the chemical treatment can do a better job, more quickly, and for less money."

Dr. Carlson emphasized the need to inform garden clubs and community improvement societies of the temporary nature of the brown, dead strips of brush which follow spraying. He said that these groups should be shown that the end result is a carpet of grass where unsightly brush once stood. Likewise, he said that groups concerned with wildlife conservation should be informed that the removal of food and cover for small game along highways and railroad embankments is, in the long run, a blessing.

"These areas are certainly not appropriate as habitat for our game birds and animals," he said. "To convince ourselves of this fallacy, we have only to count the bodies of birds and animals lying along the roadside some morning. It would be much better to encourage these creatures to frequent the haven of parks and game refuges."

EPN RECOMMENDED FOR CONTROL OF EUROPEAN RED MITE IN OHIO

EPN, the new organic phosphorus compound, "is being given first place among recommended materials" for the summer control of the European red mite in Ohio apple orchards, according to an article by C. R. Cutright in OHIO FARM AND HOME RESEARCH for March-April, 1951. This magazine is published by the Ohio Agricultural Experiment Station, at Wooster, Ohio.

"At the present time," he wrote, "a phosphonate material, EPN, is being given first place among recommended materials. It has been used experimentally for several years and in 1950 was tested by numerous growers. The reports of all tests indicate that it is the most satisfactory material known for the control of the European red mite."

EPN, technically known as ethyl p-nitrophenyl thionobenzenephosphonate, was first synthesized by chemists of the Grasselli Chemicals Department of the Du Pont Company in its experimental laboratories at Wilmington in 1947. It was tested in the fall of 1947 in the Du Pont experimental greenhouses at Wilmington and was found effective as a mite control. It was first tested on fruit trees, particularly on apples, in 1948. Extensive testing continued through 1949, with special emphasis on control of mites on apple, pear, peach, plum, and prune trees. Forty investigators in 21 states, Hawaii, Canada, and Mexico investigated EPN before it was placed on the market in the spring of 1950. During 1950, additional investigations confirmed the usefulness of EPN as a miticide and showed, in addition, that it has promise for the control of certain insects. The most important of these are the European corn borer, plum curculio, Oriental fruit moth, and cotton boll weevil.

Tiny Pest Causes Widespread Damage

The European red mite is well known in the United States, having first been identified 40 years ago. Mr. Cutright said that it has been known in Ohio for over 30 years, "but only in the last five years has it become the number one pest of Ohio apples." One reason for this is that some of the post-war insecticides, although very efficient, controlled not only the destructive insects, "but also many of the beneficial insects, some of which aided in keeping the mites in check."

The European red mite is a tiny eight-legged pest that overwinters as an egg attached to the twigs and branches of trees. Mr. Cutright said that in northern Ohio the eggs have been known to start to hatch as early as March 31 and as late as May 2.

"Hatching has been completed as early as April 20 and as late as May 2. Mites of this generation grow to maturity in about two weeks and will deposit eggs two to three days later. These are called summer eggs and practically all of them are placed on the underside of leaves. They hatch in from seven to 10 days, according to the prevailing temperature," he wrote.

"Mites concentrate their attacks on the foliage where they live and feed on the underside of leaves... Over 400 mites have been counted on a single leaf, though peak populations of from 40 to 80 per leaf are more nearly the average. The feeding of such populations for only a few days will result in severe injury to the leaf.... The mites seldom attack the fruits directly, but the injury to the foliage results in smaller fruit, poor color, and low quality."

Adequate Spray Program Essential

Based on observations over a period of 25 years, Mr. Cutright said that the only way of controlling the European red mite is through an "adequate spray program." Before the new organic insecticides appeared around 1942, the only effective spray practice was the use of a three percent oil spray, he said. This was applied in the dormant or delayed dormant period.

"Frequently, however," he added, "dormant oil will not prevent summer outbreaks of mites which will begin to appear in damaging numbers in late July or August. When this occurs, summer acaricides must be used."

Before 1951, Mr. Cutright said, the "dinitros were recommended for summer use," but they occasionally caused severe injury to fruit and foliage. Other insecticides tried also had "certain points of value although they are far from being ideal acaricides." Now, EPN is available. In recommending it, Mr. Cutright makes these suggestions:

"1. EPN is a phosphorus material, a poison that must be handled with care. Observe all directions of the manufacturer."

Du Pont suggests that protective gloves, clothing and goggles, in addition to a mask or respirator, be used when applying or handling EPN. EPN should be kept away from feed or food products and empty containers should be burned, for it is hazardous if swallowed, inhaled, or absorbed through the skin.

"2. If an oil spray was applied in the spring and mites do not appear until late July or early August, one thorough application of EPN, four ounces to 100 gallons of spray, should control the mites for the season.

"3. If mites appear in June, two applications, about two weeks apart, should give satisfactory control. EPN can be added to the regular sprays."

COMBINATION OF INSECTICIDE AND FUNGICIDE RECOMMENDED FOR SEEDS

New York State investigators, after four years of experiments, recommend that seeds of lima beans and other vegetables be treated with a combination fungicide and insecticide before planting. In this way both the fungi which cause seed decay and the maggots which attack the seed can be controlled.

The experiments were conducted at the Geneva, N. Y., New York State Agricultural Experiment Station by Wayne L. Howe and W. T. Schroeder. They described their work in the January, 1951, issue of FARM RESEARCH, (Vol. XVII, No. 1), published by the Geneva Station and the Cornell Agricultural Experiment Station at Ithaca, in an article entitled "A New Method For Seed-Corn Maggot Control."

Heretofore vegetable growers in western New York have relied for their protection against maggots mostly on planting their seed when the maggot population was at a low level. This, however, was usually just a period of four days in the first half of June. By using the combined insecticide-fungicide treatment, planting can be done when convenient. Earlier planting is therefore possible, which is an advantage in many cases.

How Various Chemicals Performed

"Arasan" SF seed disinfectant when combined with an insecticide produced the best results in the experiments. "Of insecticides tested, chlordane, lindane, dieldrin, and aldrin gave the best control of the seed maggot," said the authors.

"Arasan" is both a fungicide and seed disinfectant. It has as its active ingredient tetramethyl thiuram disulfide (thiram). It has been used for many years to protect various vegetable seeds against disease and to prevent damping-off.

Two Distinct Factors Attack Seed

Messrs. Howe and Schroeder point out that failure of beans and other crops is often due to two distinct factors -- the action of soil-inhibiting bacteria and fungi which cause seed decay, and the attacks on the germinating seed by the seed-corn maggot. This they describe as "a formidable seed destroying combination."

Seed disinfectants, they found, were adequate to prevent injury to the seed from seed-rotting organisms. Could they also protect it from the seed corn maggot?

"The maggot," the authors stated, "attacks essentially the same parts of the germinating seed as the seed-rotting organisms, but the effects are somewhat different. The small legless larvae can destroy the capacity of the seed

to come up by consuming large portions of the cotyledons or seed pieces. In the course of invading these tissues the maggot may sever or destroy the plumule which lies between these two seed pieces. As a result, the plant may emerge without a growing point...Such plants either eventually die or are unproductive." Other types of injury are also produced by the seed-corn maggot.

Fungicide Alone Unable To Do The Job

To get their answer to the question, three plantings of lima beans were made -- one of untreated seed, one of seed treated only with "Arasan," and the third of seed treated with "Arasan" combined with an insecticide. The results were as follows: the untreated seed showed both decay and maggot injury; the seed treated only with "Arasan" seed disinfectant showed very little decay, but considerable maggot injury; and the seed treated with "Arasan" plus an insecticide produced clean seedlings.

The same procedure was carried out to see if insecticides alone could do the job. "Early in the studies," the authors said, "it became apparent that, although the insecticides gave good control of the maggot, they had little or no value in controlling seed rots. In fact, under some conditions in the field, the insecticides when used alone appeared to predispose the seeds to decay."

The need for using both an insecticide and a fungicide having been established, further experiments were conducted to see what would be the best fungicide to use. "Of several fungicides tested," Messrs. Howe and Schroeder said, "'Arasan' seed disinfectant was found to be the most effective in preventing seed decay and in counteracting the toxic effects on the seeds exhibited by the insecticides."

"Arasan" - Insecticide Combination Effective

"The use of the fungicide-insecticide combination," continued the authors, "as a seed treatment for lima beans has given uniformly effective control of seed decay and seed-corn maggot injury over a wide range of planting conditions. This will enable the grower and processor to extend the planting season to cover about three weeks rather than the four to six days of maggot-free planting time."

When using the fungicide-insecticide combination, the Cornell scientists recommended the following mixture per bushel of seed: 1.3 ounces of "Arasan" SF seed disinfectant, plus one ounce of Lindane 25% wettable powder or one ounce of Dieldrin 25% wettable powder or one ounce of Chlordane 50% wettable powder, plus 1/2 pint of a sticker. The need for a sticker was described as follows:

"In applying a mixture of a fungicide and an insecticide to smooth-surfaced seeds such as lima beans and other beans, it became apparent that a sticker was needed to make the materials adhere. A 4 per cent methyl cellulose solution (Methocel) is a satisfactory adhesive. By suspending the insecticide

and fungicide materials in this solution it is possible not only to stick them on but to distribute them evenly over the surface of the seed. The use of the methocel slurry method also eliminates the irritating effects of the pesticides on the user when they are handled in a dry state."

How to Prepare Solution

No special equipment is necessary to apply the materials to the seed, according to Messrs. Howe and Schroeder. Here are their directions:

"To prepare a 4 per cent Methocel solution add 1/3 pound (5-1/3 ounces) Methocel to 1 quart of water heated to just below the boiling point. Stir and allow to soak for 20 to 30 minutes. Add 3 quarts of cold water to make 1 gallon of solution and stir until smooth. Allow to cool with occasional stirring. Store in containers with tight-fitting lids.

"Weigh out proper amounts of insecticide and fungicide and shake in closed container until thoroughly mixed. Add this dry mixture to the required amount of 4 per cent Methocel and stir until smooth.

"Place seed in a flattened pile on a clean smooth floor or tarpaulin. The proper amount of slurry mixture is then distributed over the seed.

"Immediately rake seed to distribute slurry, with occasional shoveling to insure thorough mixing. Continue the raking and shoveling until seed is dry.

"Another method of preparing the treatment mixture is to add the proper quantity of a dry form of Methocel directly to the insecticide and fungicide before wetting. This dry mixture is then slowly added, with stirring, to the required volume of water. It should be stirred until a smooth dispersion is obtained. For example, to treat 1 bushel of beans, mix dry 1 ounce of Lindane, 1-1/3 ounces of 'Arasan' SF, and 1/3 ounce powdered Methocel; add slowly to 1/2 pint of water."

Since the effect of storing seed treated with this combination has not yet been studied, "it is suggested that treatment be made not over three weeks before planting."

DYNAMITE USED TO MAKE DITCH WHERE HEAVY MACHINERY COULD NOT ENTER

Four hundred pounds of dynamite and one day's labor were the total investment required to dig a 500 foot ditch that drained more than 100 acres of cropland for M. W. Runsick, Newport, Jackson County, Kentucky, Assistant County Agent Richard Maples reported. This information was released by the University of Arkansas College of Agriculture.

Mr. Runsick's drainage problem was caused by the lack of a suitable outlet for surface water. During wet periods, water from his fields drained into a wooded swamp which frequently overflowed back across his land. A high dredge ditch spoil bank prevented drainage from the swamp.

Acting on Kentucky Agricultural Extension Service recommendations, Mr. Runsick set one row of charges down the middle of the place for the ditch, and a row of half-charges on each side. The ditch was blasted across the swamp and through the spoil bank. Mr. Maples said it would have been practically impossible to move heavy equipment in to dig the ditch because of the extremely muddy condition of the swamp. Besides reclaiming valuable cropland, the ditch also drained the woods swamp which was causing trouble as a mosquito breeding area.

VISCOSE PROCESS YARN AVAILABLE IN NEW FORM

Fiber E, the newest form of the oldest of man-made textile fibers -- rayon -- is in limited commercial production at the Old Hickory, Tenn., plant of the Du Pont Company.

This version of rayon has the property of curling or crinkling into a fuzzy, wool-like fiber when treated with a dilute solution of caustic soda. When combined with yarns of other fibers, it imparts a carved effect to cut, brushed, and loop-pile fabrics and will produce a two-tone color effect from a single dye bath.

Among the uses for Fiber E are throw rugs, upholstery, draperies, cuddle toys, fur-like fabrics, and for nubby surface effects. Fabrics designers are employing it alone and in combination with regular viscose process rayon and cotton.

Fiber E, a type of viscose process rayon, is regenerated cellulose. To the eye, a wound package of conventional viscose process yarn and a wound package of Fiber E are indistinguishable. Chemically, they are also similar. But the physical properties of the new fiber set it apart from any other textile product.

POST-HARVEST SPRAYING TO CONTROL PERENNIAL WEEDS IS RECOMMENDED

A post-harvest spraying program, followed by intensive cultivation, is a good practice for the control of deep rooted, noxious perennial broadleaf weeds in the Northwest states, Arden M. Aanestad, agricultural specialist of the Grasselli Chemicals Department of the Du Pont Company said recently. He spoke at a meeting of the Northwest Farm Managers Association in Fargo, N. D.

Mr. Aanestad pointed out that fighting the perennials is a difficult, year-round job. "The spectacular visual results that are obtained when spraying for mustard in flax, for instance, cannot be expected to any extent when spraying for the perennials," he said.

One of the basic factors in applying chemical weed killers, he said, is that the best time for spraying is when the plant is growing rapidly, which is generally near the bud and blossom stage. He added that an application of chemicals in the fall, followed by intensive cultivation of the soil, is also a good practice because it weakens the plants just before winter sets in.

Herewith are the principal points Mr. Aanestad discussed in his talk:

Control is Possible, Eradication Difficult

"In this discussion I will attempt to outline the chemical control of noxious perennial broadleaf weeds common to our Northwest area only. When we talk in terms of the use of chemicals in combatting weeds, we use the word 'control' nearly entirely, and omit the word 'eradication' as much as possible. The use of the term 'control' is especially true in fighting the perennials.

"The simplest definition of the word 'perennial' as we use it in weed control is a weed that lasts year after year. The above-ground parts produce seed each year, but die in the fall and emerge from live roots the following year.

"The Canada thistle, perennial sow thistle, leafy spurge, field bindweed (also known as creeping jenny), are of more concern to us in this area than any others.

Chemical Must Penetrate Beneath Soil

"As we can easily ascertain from the nature of the plant, we have to have a chemical weed killer that not only kills or at least knocks down the aerial parts of the weed, but also penetrates into the below-ground systems, and kills or at least weakens the root system.

"This is why the new hormone type weed killers, such as 2,4-D, have become increasingly more important in the past three or four years. Up to that time the soil sterilant types of killers were used entirely, primarily for small patches.

"There are perhaps two principal ways in which we can effectively combat these perennials with 2,4-D and its relatives. They are: (1) an application applied in crop and (2) without crop: for example, in summer fallow. There are, of course, combinations of these two methods, and these methods in combination with cultivation.

Benefits From Selective Weed Killers

"There are three distinct benefits that can be realized from chemical control in the crop itself: (1) A reduction in seed set or, in some cases, elimination of any seed set of the weed. (2) A reducing of the vigor and less dockage. (3) A weakening of the root system which, with repeated applications of chemicals and cultivation will lead to eventual death of the entire system. These benefits can be obtained in non-crop areas also. Farmers do not look upon 2,4-D as a miracle type weed killer as they did when it made its debut. It is rather becoming an established farming practice. It is only a valuable adjunct to better farm management.

"When using 2,4-D there are two ways in which we must regulate the rates per acre. They are based upon the use of the material, whether it is for an infestation in a growing crop or in fallow or pasture land.

Tolerance of the Crop Must Be Considered

"There are the two basic things to remember. We must regulate our rate to the tolerance of the crop species, taking into consideration the most tolerant period of the crop.

"When we use it out of crop, we adjust the rate to get the optimum benefit from the chemical and the timing of application to the most susceptible stage of the weed.

"One of the basic factors to remember is that the best time for the application of 2,4-D is when the plant is growing rapidly, which is generally near the bud and blossom stages, for it is then most vulnerable.

Recommendations for Canada and Perennial Sow Thistle

"When using 2,4-D in grain crops a rate of ½ lb. of 2,4-D acid equivalent has given good control of both species when applied during the bud stage. At this rate the above ground parts are knocked down and the plant is kept from setting seed.

"For use in summer fallow or as post-harvest when the thistle has resprouted and is again budding, applications of 2,4-D should be applied during the bud or pre-bloom stage if possible. The rates should be boosted to 1½ to 2 lbs. of acid equivalent per acre.

"It usually takes two applications per year for a period of two or more years to eradicate these weeds.

"There seems to be little or no difference as to the formulation used. Either the amine salt or the ester gives good results, the ester being the much faster in action.

"In controlling the weeds in crops it is of utmost importance to have spray booms set high enough to get the material on all the plants, especially the budding portions.

"Intensive cultivation following an application of 2,4-D in the fall is a good practice and greatly enhances the kill by weakening the plants just before winter sets in.

Leafy Spurge, Russian Knapweed and Hoary Cress

"When infestations are to be controlled in grain crops, applications of 1 lb. of 2,4-D acid equivalent per acre are recommended. The amine salt is preferable. These should again be applied during the early bud stage. From this treatment we can expect abnormalities in the weeds which prevent normal competition with the crop and reductions in seed set. A reduction in stand cannot always be had at this rate.

"For control in solid stands, rates of 2 to 3 lbs. of 2,4-D acid equivalent should be used. Here the ester formulations can also be used. Thorough coverage is of utmost importance. More carrier than normal should be used in non-crop infestations. Reinfestation from seed is prevalent and these seedlings can be destroyed by reduced rates of 2,4-D.

"The use of 2,4-D in combination with 'Ammate' weed killer (ammonium sulfamate) has produced better results than either of the materials alone. The effectiveness was increased about 10%.

"In general we cannot expect complete eradication of leafy spurge with these materials. In only a few locations has this been done, and this was when five applications had been applied over a two year period.

"The seeding of adapted grasses after the leafy spurge is under control with 2,4-D is probably the most feasible way to actually eradicate the weed.

Field Bindweed or Creeping Jenny

"Bindweed is most susceptible at the fast growing stage. The optimum time for application is in the bud and bloom stages.

"When applications are made in crops, rates of at least ½ lb. 2,4-D per acre are recommended. It is advisable to control this weed out of crop if possible, using 1 lb. of 2,4-D. Increased rates of 2,4-D on this crop do not

seem to give any better control. Both the ester and amine salts are effective. Here again the use of grasses in combination with chemicals greatly enhances the results, and speeds-up the reductions in stand. To summarize:

Summary

"1. Have an attitude of control rather than elimination or eradication when using weed killers.

"2. Rates of application must be determined on control of these perennials in crop, post-crop and non-crop and combinations.

"3. The use of adapted grasses and other good agronomy practices, along with chemical applications, is important.

"4. And above all, maintain a persistent but patient attitude toward the end results."

RESEARCH ON WET-STRENGTH PAPER INTENSIFIED IN NEW LABORATORIES

DEEPWATER POINT, N.J. —— The promise of a "procession of intriguing new products" was held out recently by Dr. Samuel Lenher at ceremonies here dedicating the Du Pont Company's new quarter-million dollar addition to its rubber research laboratories. He is assistant general manager of the Organic Chemicals Department, which operates the laboratories.

Emphasis will be on evaluation and development of new and improved latex products derived from neoprene, the company's special oil and sunlight resistant synthetic rubber, Dr. Lenher said. Among products earmarked for early attention are new shoe adhesives; fire retardant sponge for upholstery; high-flying weather balloons; bonded fibers for upholstery cushioning; and paper that can be soaked with water and still remain strong.

The "wet strength" paper is made by adding a small amount of neoprene latex to the pulp as the paper is being made. The tiny neoprene particles deposit on the paper fibers and act as a water-proof binder.

A number of products based on the union of neoprene and paper are already on the way. Used as the backing for a new install-it-yourself plastic wall tile, neoprene-treated paper produces a tile that is said to be more supple, easier to install, less subject to cracking. Other applications cited by the company include inexpensive waterproof tarpaulins, high-strength printing paper, multiwall bags, carton liners, and industrial filter paper.